Anonymous Referee #1
Interactive comment on "Deglacial sea-level history of the East Siberian Sea Margin" by Thomas M. Cronin et al. Anonymous Referee #1 Received and published: 26 April 2017 Interactive comment on Clim. Past Discuss., doi:10.5194/cp-2017-19, 2017.

The paper "Deglacial sea-level history of the East Siberian Sea Margin" has the aim to reconstruct and estimate, from sediment cores, the paleo-depth in the eastern margin using benthic foraminifera and ostracode species. Thought the results are discussed properly and they could be relevant for a large audience, I am not convinced by the dating of the cores. Without a confident age calibration all the discussion given in the manuscript are of secondary importance. The results obtained by the authors can be much improved if the age scale and the confidence associate with the dating of the core will be improved. The chronology of the lower section of core PC1 is based only on 5 points (6 with the outlier) where four of them suggest a similar age, though they cover 33 cm of the core. Considering this uncertainties and lack of age calibration points in the bottom C1 part of the core I would be careful in assume an almost linear relationship depth vs age to date the bottom part, especially for the time periods investigate.

Response: We agree it is important to discuss the uncertainty about a) C14 dated intervals and reservoir corrections and b) the lower part of 4-PC1 core, 500-600 cm core depth which is not directly dated. Here are revisions to address these.
a) **The use of a particular reservoir correction in the Arctic has been contentious for years and we do not deny there may be several choices both for calibration [see Hanslik et al. 2013 QSR] and choice of material dated. For our particular Siberian and Chukchi margin cores, we refer to the papers of Pearce et al. and Jakobsson et al., both in this CP volume, for our rationale in using a lower delta R number (50 yrs) for the pre-Holocene/Deglacial than for the Holocene (200 yrs). In our own text, this is made clear on page 4. In Jakobsson et al. Supplement Fig 1, using 3 different delta R values (50, 300, 500 yrs) for NOSAMS date 131218 results in about 118 year range in calibrated ages (11,065, 10,788, 10,547 years) at the time the Bering Sea was flooded, roughly 11,000 years ago. The ages on the dated sections of the SWERUS cores may or may not be equivalent to those from the Laptev Sea.**

b) **We noted the age uncertainty in the revision; calcareous fossils were not abundant enough below this level to obtain an AMS data. The text reads "possibly" in regard to marking the onset of the YD.**
Also, we added a section of text to this effect.
"Marine sediments deposited during the last glacial maximum are uncommon in the central Arctic Ocean due to the extensive sea ice and ice shelf cover. For example, Polyak et al. (2004) documented a hiatus between 19 and 13 ka in several cores from the western Arctic. In a compilation of 199 new and published calibrated radiocarbon dates from the central Arctic Ocean, Poirier et al. (2012) found similar results: no dates at 21-22 ka, 4 total from 19-15 ka, 4 dates from 14-15 ka, 5 dates from 13-14 ka, and a spike up to 13 dates

between 12-13 ka. Several studies of Arctic Ocean margins have recovered deglacial sediments. Taldenkova et al. (2013) found the earliest deglacial dates of 15.34 and 15.37 ka in core PS51/154-11 at 270 mwd in the Laptev Sea. These correspond to the first appearance of common benthic foraminifera. Scott et al. (2009) dated sediments from piston core PC750 (1000 mwd) off the Mackenzie Trough, on the Canadian margin, at 11.3 cal ka at 180 cm and 13.3 ka at 380 cm. Benthic foraminifera first become common in core PS750 at ~11.3 ka. In core PS2138-1 (995 mwd) from the Barents Sea slope, north of Spitzbergen, Wollenburg et al. (2004, see also Matthiessen et al. 2001, Norgaard-Pedersen 2003) dated one of the more complete LGM-deglacial sequences with nine calibrated radiocarbon ages from 23.88 to 15.52 ka from 275 to 65 cm core depths. Unlike the Laptev Sea, Siberian and Canadian margins, relatively continuous sedimentation in this region during this period reflects complex changes in productivity and oceanography during Greenland Stadials GS-2 (21-14.6 ka) and GS-1 (14.6-11.6 ka, Bølling-Allerød, Younger Dryas) largely due to changes in inflowing warm Atlantic Water and the West Spitzbergen Current. In sum, these few examples show that the earliest ages for deglacial sedimentation and preservation of abundant benthic microfaunas (and by inference productive benthic ecosystems) varies along different Arctic Ocean margins. Thus, pending further investigations, we cannot completely exclude the possibility that the lowermost sediments below 500 cm core depth in 4-PC1 are older than ~13 ka."

The periods between 10 ky and 15 ky BP in the Arctic, have been characterize by rapid climate changes brought to different climate condition. In this period we can distinguish three different climate phases, the Younger Dryas, the Bølling-Allerød interstadial and the early Holocene. These periods could have been characterized by different deposition and sedimentation rate making the assumption of a linear sedimentation rate below the lowest date not convincing. The core 20-GC1 shows a similar age between 55 to 90 cm depths. Could the continuity of these sediments be disturbed and reshuffle by the Fennoscandinavia ice sheet movement?
Response: Yes reworking of dated material in 20-GC1 is possible and we clarify this point, although we don't know if ice sheet or ice shelf margins are involved, or sedimentary or biological processes on the upper slope.

Without additional information improving the core chronology, especially for the bottom part of the PC1 core, the discussion present by the authors are not convincing.
Response. As stated above, our focus was on the significance of the well-documented [multiproxy, geophysics etc] transition in 4-PC1 core at 413-400 cm core depth. The more subtle microfaunal shift in the interval 500-413 cm is well-dated by 5 dates and the delta R correction is defended here and in other papers in this volume. However, the reviewer feels it is necessary to also date the oldest deglacial sediments at 600-500 cm core depth, which unfortunately lack enough suitable material. The new paragraph added to the

text (see above) concedes this. In light of reviewed records from other Arctic margins providing previously published ages of deglacial sediments, the upshot is that rarely are sediments dated from the LGM up to 14-15 kyr from the Arctic except near regions north of Spitzbergen. This is most likely due to extensive thick ice shelf and sea ice cover until well after the Bølling-Allerød.

We added the following sentence at the end of the discussion:

"Arctic Ocean deglaical sea level history remains incomplete, however, and it will be necessary in future studies to extend the deglacial sea level record back to the early stages of deglaciation prior to the Younger Dryas. "

In sum, with all due respect, Arctic sedimentary chronology and depositional history cannot simply be viewed from the standpoint of radiocarbon dating. It must be interpreted in light of many factors: LGM ice extent, geophysical profiles of cored locations, physical stratigraphy, ice rafting, the rate of sea level rise, sedimentation rates, spatial variability in Arctic sea ice, land ice, ice shelves, paleoceanography, core location with respect to inflowing Atlantic Water (and Pacific water through the Bering Strait), riverine freshwater and sediment input, and submarine geomorphology of the continental margin. The context for the Siberian/Chukchi margin sea-level record in this paper is given in the transects of cores shown in Figure 2 and 3 and in additional papers on these cores.